D1 Cont.

simultaneous application of heat and pressure, at least one said structural ply having a machine direction modulus of elasticity of at least 7500 MPa, and a cross machine direction modulus of elasticity greater than 4500 MPa, and wherein said at least one structural ply exhibits a squareness of less than 2.40, wherein the squareness is a ratio between the machine direction modulus of elasticity and the cross machine direction modulus of elasticity.

REMARKS

Favorable reconsideration and allowance of this application are requested.

By way of the amendment instructions above, independent claim 18 has been revised so as to clarify the same and to remove the issues raised by the Examiner under 35 USC §112.

The only issue remaining to be resolved in this application, therefore, is the Examiner's rejection of claims 18-23 as allegedly obvious from Qui et al (USP 5,505,395) in view of Beard et al (USP 4,729,175). Applicants suggest that all claims pending herein are patentably distinguishable over the applied references.

The problem solved according to the present invention is how to achieve a core that has better stiffness -- i.e. better beam strength to meet with the new demands of e.g. the printing presses. In other words, the applicants' goal was to achieve a core whose critical revolution is higher than in known cores. In the widest printing presses, which require a wider/ faster web, the inside diameter of the core has been changed to 150 mm in order to solve the vibration problem. So far, this arrangement has functioned well. Now, the same problem as with earlier machines, until transferring to 150 mm cores, will be faced again with the running parameters of the new machines being designed. In other words, the risky range of natural vibration of the rest reel will again be revisited.

For this reason, the stiffness of the core has to be increased in one way or another, while avoiding an increase in the inside diameter of the core. The solution the present

applications have offered to these problems is to construct a multiply core having at least one ply that has been manufactured of coreboard made by a specific press drying method know as the Condebelt-method.[2]

Thus according to the present invention, the high value of the modulus of elasticity of the Condebelt board in the cross machine direction is an important factor in the present invention ***combined with*** the high modulus of elasticity in the machine direction. As the art of record evidences, however, board having a high modulus of elasticity in the machine direction can be manufactured. But in such cases, the modulus of elasticity in the cross machine direction remains substantially low. In other words, those skilled in the art recognise the "fact" that, if a modulus of elasticity is made relatively high in one of the machine or cross machine directions it will be low in the other direction.

Applicants note that Qui et al discloses a cross machine direction modulus of elasticity of 0.53 M psi which corresponds *only* to 3660 MPa. The present invention, of course, specifically requires that the cross machine direction modulus of elasticity be ***greater than*** 4500 MPa. Hence, the structural ply of Qui et al does ***not*** inherently possess a cross machine direction modulus of elasticity as defined in the present applicants' claims.

Nor can Qui et al be considered to render obvious the present invention. In this regard, Qui et al merely discloses a multi-grade spirally wound paperboard winding core. The winding core of Qui et al has a central paperboard layer formed from lower density paperboard, and outwardly located structural paperboard layers formed from higher density paperboard. One main object of the Qui et al disclosure is to minimize the reduction of the inner diameter of paperboard winding cores ("ID comedown") under radial compression forces during a winding process. For this purpose, Qui et al provides multi-grade paperboard winding cores having a plurality of structural paperboard plies of different densities and strength. IN order to achieve an increased

[2] In order to assist the Examiner in his understanding of the Condebelt method, several articles are attached for his technical review and are listed on an appropriate form PTO-1449 for the Examiner's convenience.

radial stiffness of the cores, structural plies having a high modulus of elasticity in the machine direction are provided.

Table 1 of Qui et al shows that the stiffness (modulus of elasticity) of the structural plies in the cross machine direction is by a factor of approx. 3.0 *smaller than* in the machine direction. For the relatively large winding angles a of the cores ($\alpha > 55°$ according to Qui et al (col. 8, lines 6-8), the stiffness of the structural plies in the cross machine direction has only a relatively small influence on the ID comedown. However, the stiffness of the structural plies in the cross machine direction determines the axial stiffness as well as the bending stiffness of the core under static and dynamic load. Meanwhile, for the relatively large winding angles $\alpha > 55°$, the high stiffness of the structural plies in the machine direction of Qui et al hardly improves neither the axial stiffness nor the bending stiffness of the core under static and dynamic load.

As a result, the highly anisotropic properties of the structural plies according to Qui et al lead to a ***low axial stiffness and bending stiffness of the core*** as compared to its resistance to ID comedown. Therefore, paperboard cores according to Qui et al are not appropriate for applications where high axial and bending stiffness are required, e. g. by the running parameters of new printing presses.

In direct contrast to Qui et al as discussed above, the present invention provides a spirally wound paperboard core with a structural ply having a high axial stiffness and bending stiffness of the core, under static and dynamic load, without a need to change the core structure in any other way ***except*** for the raw material. In this regard, the "raw" material for the core are the plies that are wound into the core. As discussed immediately above, technical problem underlying the present invention is not addressed at all by Qui et al.

According to the present invention, the problem mentioned above is solved by, among other things, the definition of a target range for the squareness (< 2.4) of the structural ply along with a minimum modulus of elasticity in the cross machine direction of the structural ply ($E_{CD} \geq 4500$ MPa). Furthermore, in order to achieve these material

properties, the structural ply is defined to be press-dried under simultaneous application of heat and perpendicular pressure to the moist paper.

Due to these technical features, the underlying technical problem is solved. In particular, the relatively low squareness, i.e. the relatively high isotropy of the structural ply leads to a high axial stiffness and bending stiffness of the core under static and dynamic load without a need to change the core structure in any other way except for the raw material.

An ordinarily skilled person would clearly not be directed to such technical features by the disclosure in Qui et al. Indeed, as noted previously, such an ordinarily skilled person would have been led directly away from the technical features of the present invention.

The Examiner apparently has overlooked the technical features discussed above (which were likewise previously submitted with the applicants' responsive amendment of February 12, 2002), and instead has asserted that the only difference between Qui et al and the present claims is that the former fails to disclose a core comprising a structural ply which is made by press drying. The Examiner then turns to Beard et al for such an alleged teaching.

Beard et al merely talks about press-drying which is improved with the use of ultrasound. The only thing the Examiner can rely on is the word "paperboard" in the specification. Beard et al teach that press-drying is used for drying and compacting paperboard. Applicants certainly do not dispute that such a use as disclosed in Beard et al has been known for decades. Yet, no one has ever suggested the use of such a paperboard in the manufacture of spiral paperboard cores. The conventional use for press-dried paperboard has been in the packaging industry, where the wrapper needs good strength qualities. The use of press-dried paperboard in the manufacture of cores is thus clearly ***not*** obvious to one skilled in this art.

The combination of Qui et al and Beard et al is therefore not proper. Indeed, Beard et al does not suggest at all that press-dried paperboard may be used in the manufacture of cores. The ***un***obviousness of the present invention is even further bolstered by Qui et al. In this regard, as noted previously, Qui et al teach the moduli of elasticity but does not suggest that such should not be the one given in his specification and, as such, there is no motivation to change the same. Also, Beard does not specifically teach that with his product the moduli of elasticity would be something different. In applicants' view, there is a wide gap between the two applied references as they do not include any disclosure whereby an ordinarily skilled person may be able to bridge the same.

In view of the above, therefore, applicants suggest that this application is in condition for allowance and early receipt of the Official Notice thereof is solicited.

Respectfully submitted,

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APPENDIX I

Marked-Up Version of Amended Claims Pursuant to 37 CFR §1.121(c)

18. (Twice Amended) A spirally wound paperboard core comprising a plurality of structural plies made [from moist paper] <u>of paperboard manufactured by a press-drying process under simultaneous application of heat and pressure</u>, at least one said structural ply having a machine direction modulus of elasticity of at least 7500 MPa, and a cross machine direction modulus of elasticity greater than 4500 MPa, and wherein said at least one structural ply [being formed by press-drying under simultaneous application of heat and perpendicular pressure to the moist paper thereby to cause said at least one structural ply to exhibit] <u>exhibits</u> a squareness of less than 2.40, wherein the squareness is a ratio between the machine direction modulus of elasticity and the cross machine direction modulus of elasticity.